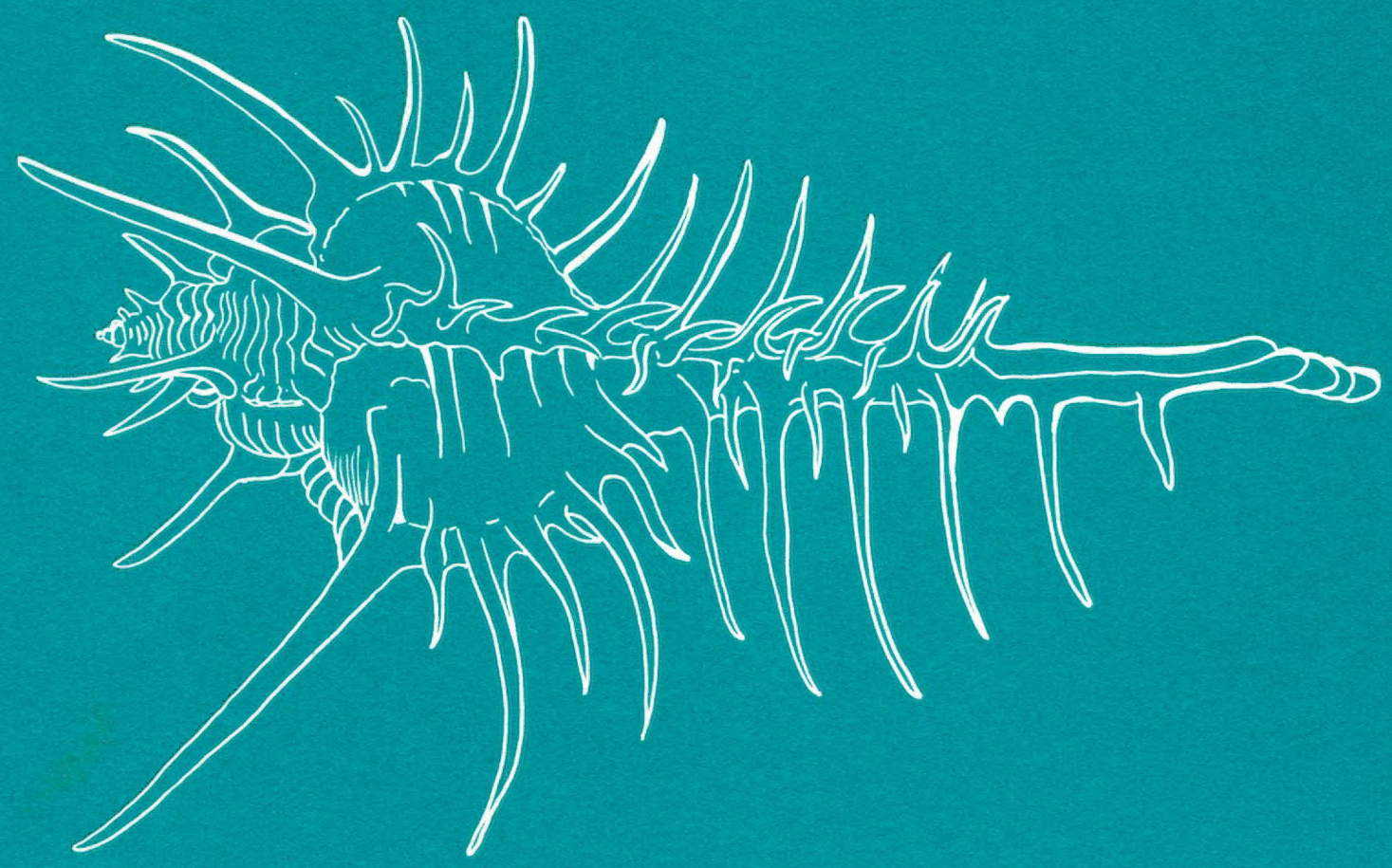
ANNUAL REPORT OF THE CALIFORNIA ACADEMY OF SCIENCES 1969-1970



AN INVITATION TO MEMBERSHIP

When you become a member of the California Academy of Sciences you become a part of one of the great natural science museums of the world. Your membership card entitles you to free admission to the Academy and admits you to its monthly membership meetings. Present it at our sales desks and receive a 10% discount on all purchases. You will receive complimentary tickets to Morrison Planetarium, a subscription to the Academy's journal, *Pacific Discovery,* and the monthly *Newsletter.* You are eligible for trips planned especially for members. In addition, your membership helps the advancement of science through the research and educational activities of the Academy. An application for membership is on the reverse side.

APPLICATION FOR MEMBERSHIP

I wish to make application as a ..... member in the
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"Friends of the Academy"	☐	$1,000	Life Member	☐	$300
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CALIFORNIA ACADEMY OF SCIENCES, GOLDEN GATE PARK, SAN FRANCISCO 94118

ANNUAL REPORT OF THE CALIFORNIA ACADEMY OF SCIENCES 1969-1970

A MESSAGE FROM THE CHAIRMAN..... 3
REPORT OF THE DIRECTOR..... 4
RESEARCH ACTIVITIES 11
STAFF 16
STAFF BIBLIOGRAPHY 18
FINANCIAL STATEMENT 21
CONTRIBUTORS 24

CALIFORNIA ACADEMY OF SCIENCES
GOLDEN GATE PARK, SAN FRANCISCO, CALIFORNIA 94118

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A MESSAGE FROM THE CHAIRMAN

IT is interesting to contemplate the catalytic agents which work together to bring about a strong, privately-supported institution in the natural science research world. There are, of course, the obvious—an enthusiastic and strong Board of Trustees to provide adequate resources of all kinds, a skilled direction of the institution and an environment that attracts competence in the research staff and encouragement to quality and distinction in research.

In the past few years the California Academy of Sciences' research staff has grown substantially. It is recognized nationally and internationally for its research productivity, and its members are in demand as officers and directors of major scientific societies. They also participate in local, national and international conservation projects. With the environmental problems coming upon us so rapidly, the Academy will be increasingly involved in this area.

This year our President, A. Starker Leopold, and our Vice President, Ralph Emerson, were elected to the National Academy of Sciences. This is the highest honor to be conferred upon an American scientist. Dr. Leopold and Dr. Emerson are Professors of Zoology and Botany at Berkeley. The Academy has had long and close relationships with Berkeley and Stanford and other Bay Area universities and colleges.

Academy research scientists produce a large volume of published scientific works in their specific fields, as reported in each year's annual report. They also author splendid books and popular articles for the general reader, such as Robert C. Miller's "The Sea," Earl S. Herald's "Living Fishes of the World," and Robert T. Orr's "Animal Kingdom," and most recently, "Animal Migration." Dr. Edward S. Ross is a frequent contributor to the "National Geographic Magazine" and during the report year prepared a series of 180 enlarged color photographs of natural history subjects which will be reproduced and distributed for school and other educational purposes by the McGraw Hill Company.

Thus the Academy's staff met its responsibilities to the broader scientific, educational, and lay communities. Many of the curators instructed courses for the students of Bay Area universities and colleges, and assisted graduate students with their special research problems, using the Academy's collections, library and facilities. More than twenty of the staff serve as officers and directors of major scientific societies locally and nationally.

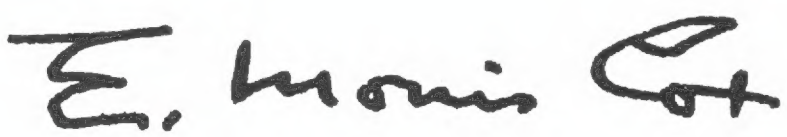
Director George E. Lindsay is President of the 19,000-member Pacific Division of the American Association for the Advancement of Science, and is a member of the Executive Committee, Council, and Accreditation Commission of the American Association of Museums. He was a spokesman for science museums on national committees of the National Science Foundation, the American Association of Museums, and before Congressional committees as well as for several conservation organizations. Locally he served on the Advisory Committees of the Lawrence Hall of Science of the University of California, the Greater Bay Area Science Fair, and the Federal Industry Educational Council.

Associate Director Robert T. Orr was President of the Cooper Ornithological Society, Director of the American Ornithologists' Union, member of the Advisory Board of the Charles Darwin Foundation, and member of the American delegation of the U.S. State Department to negotiate a treaty with Japan concerning migratory and endangered species of birds. Dr. Orr was active in many other national and local scientific organizations.

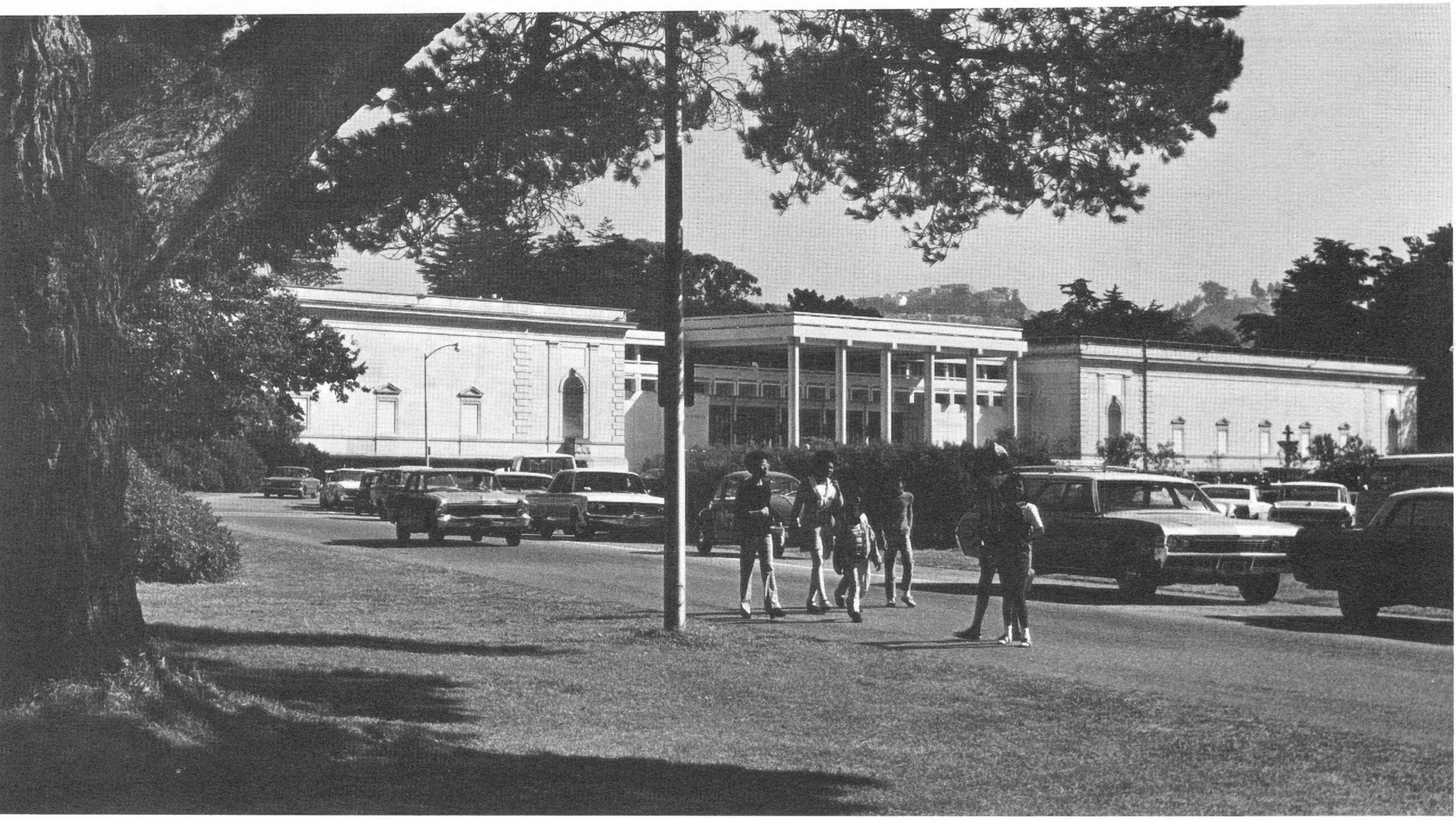
Associate Director for the Aquarium Earl S. Herald was Chairman of the San Francisco Bay Marine Sciences Program, Vice President of the San Francisco Zoological Society, board member of the Micronesian Institute, Vice President of the San Francisco Institute of Animal Behavior, and was a committeeman of the American Institute of Biological Sciences, American Fisheries Society, American Society of Ichthyologists and Herpetologists, and other organizations.

This list of positions held and services rendered could be expanded to include achievements of each of the Academy scientists. But more important, perhaps, is the recognition that the Academy's staff strives to meet its obligations in the world of science.

We are grateful to our friends, the City and County of San Francisco and the individuals, corporations, and foundations who have provided their generous financial support during this past year. Without that help the activities recorded in the following report would not have been possible.



E. MORRIS COX
Chairman, Board of Trustees



REPORT OF THE DIRECTOR

JUNE 30, 1969 to July 1, 1970 is the fiscal year covered in this report, the 117th of the California Academy of Sciences. It was a good year for the Academy, one of "settling into" and enjoying the new facilities of Cowell Hall. While there was continuing fiscal stress, there was also progress and growth. The membership increased twenty-five percent and attendance at the monthly members' meetings became so heavy it was necessary to schedule two sessions for each one. A docent program was initiated and two classes of these volunteer museum guides were graduated and began their service. Academy scientists traveled around the world in pursuit of new knowledge of its animal inhabitants, and 880 pages of scientific reports were published.

Five Foucault pendulums were manufactured by the Instrument Shop for installation in other cultural and educational institutions. The Junior Academy had its most active year, with more ambitious field study programs, classes and members than ever before. The Exhibits Department staged special shows, from "Printing Transforms the World—Johannes Gutenberg, 1400-1468" to "Moon Rock" with the help of NASA.

While there was progress in most areas of activity perhaps the most important accomplishment was that of gaining the approval of San Francisco voters and Supervisors for an admission charge to relieve the financial problems of the Academy and help provide funds for essential improvements.

HIGHLIGHTS

The 1969 Annual Meeting was held October 1, and was attended by 1200 members and guests. Mr. E. W. Bullard, Jr. was elected to the Board of Trustees. On April 1, 1970 Dr. Lincoln Constance was elected by the Board of Trustees to fill the unexpired term of Mr. Richard Guggenhime, who had found it necessary to resign because of increasing demands on his available time by other organizations. The full Board of Trustees had eight regular meetings during the year.

Dr. Robert C. Miller, Senior Scientist and past Director of the Academy, was the recipient of the Fellows' Medal for 1969. The award was in recognition of his distinguished services and contributions to science, and was made at the Banquet of the Fellows which was held October

25 in Steinhart Aquarium. Dr. Kenneth Pitzer gave the principal address of the evening.

The 17th Annual San Francisco Bay Area Science Fair was held at the Academy and was open to the public May 11 through 16. The First Annual Fungus Fair of the San Francisco Mycological Society was held on December 14, and "Fins on Revue," the San Francisco Aquarium Society fish show was held September 5 through 7.

A little sample of the moon, collected at Tranquillity Base by Neil Armstrong in July 1969, was exhibited during June. The glittering gray-black rock is 3.62 billion years old.

FIELD WORK AND EXPEDITIONS

The exploration of the natural world remains a prime function of any great natural history museum. Some field investigations require only the observation of animals and their behavior and the recording and interpretation of data. For other studies it is sometimes necessary to collect and preserve representative samples of the biota. During the year Academy scientists searched far and wide in their quest for knowledge.

Dr. and Mrs. William N. Eschmeyer traveled around the world studying Indo-Pacific scorpionfishes, with support from a National Science Foundation grant. Scorpionfishes are medically important and commercially valuable, but many species are little known. The five-month trip included ten days of field work in the Great Barrier Reef, as part of an annual Australian Museum trip there, but most of the time was spent studying ichthyological collections in museums.

Dr. Edward S. Ross also traveled around the world, collecting insects and taking photographs, on an eight-month trip which started October 14, 1969 and was completed June 18, 1970. He was in Africa most of the time. Michael E. Irwin, a graduate student at the University of California, Riverside, was a member of the Ross party for three months.

Academy Director George Lindsay made a seven-week trip around the world with support from the Belvedere Scientific Fund. A major part of the project was filming a motion picture on the ecology of the East African savannas.

Mr. Karl Switak, Aquatic Biologist (Herpetologist) with Steinhart Aquarium, took a leave-of-absence without pay in order to make a seven-month around-the-world herpetological study and collecting trip which included several months in Africa. Mr. Switak obtained many reptiles for Steinhart Aquarium exhibits.

Curator of Geology G Dallas Hanna and Mrs. Hanna spent October through December, 1969 in Australia, New Zealand and the Far East visiting classic diatom localities and studying collections in various museums.

A 39.55 carat, deep-blue Tanzanite gem was accepted for the Academy by Director George E. Lindsay, above. Mr. Eugene S. Scott presented the gift from Tiffany and Co. Tanzanite was discovered in 1967 in the foothills of Mount Kilimanjaro, near Arusha, Tanzania. A piece of the moon, left, collected by astronaut Neil Armstrong at Tranquility Base during the Apollo 11 visit was exhibited. Through argon-40/argon-39 dating the age of the sparkling, vesicular crystalline rock was found to be about 3.62 billion years old.

Dolphins are ever-popular features at Steinhart Aquarium, which displays more than 5000 specimens of aquatic animals. Below, a round-the-world collecting trip was undertaken by aquarium herpetologist Karl Switak, right, with Chris Barris in the Mauritanian Sahara.

STEINHART AQUARIUM

Earl S. Herald, Associate Director. Steinhart Aquarium is the most popular department of the Academy and probably is the most visited aquarium in the world. The fact that 47,104 living animals were accessioned during the year helps explain the diversity and quality of the exhibits, for which all of the staff are to be congratulated. The most noteworthy of the accessions was a Pakistan blind dolphin which Mr. and Mrs. Elkan Morris obtained from the Indus River and personally delivered to the aquarium as their generous gift. Mr. and Mrs. Morris made an around-the-world collecting and investigating trip for the aquarium and obtained many reptiles and other exhibition animals.

Summer collecting activities focused on the Gulf of California with some twenty divers, aquarium associates and staff, operating from the *Marisla* out of La Paz. The choice fishes captured and now on display at Steinhart include its first golden grouper, jawfishes, garden eels, and many others.

Dr. Herald served as Chairman of the Marine Sciences Coordinating Council, which was responsible for giving some 4,000 Bay Area high school students shipboard training in oceanographic techniques. This unique program, funded by the San Francisco Foundation and the National Science Foundation, stresses the aquatic values of Bay ecology and environment.

MORRISON PLANETARIUM

Captain Robert D. Risser, U.S.N. (Ret.) Supervisor. The 931 public programs presented by the planetarium during the year attracted 156,495 persons, and 38,697 students saw one of the 126 special educational programs. The total attendance was 207,462.

Live music was experimentally introduced in five special programs, one using a Moog synthesizer, two with a harpsichord and two which combined the Moog and harpsichord. These were unusual audio-visal experiences, and a modestly expanded program is planned for the coming year.

New skyline projectors, manufactured by the Instrument Shop, were installed around the planetarium dome and improvements were made in the sound capability and equipment.

The Alexander F. Morrison Planetarium was opened eighteen years ago and more than two million people have enjoyed the programs which it has made possible. A whole generation has learned about the universe under the simulated skies of Morrison. The planetarium is a financial as well as a cultural asset, and a glance at the auditors' report

will show the support which it provides other Academy departments.

INSTRUMENT SHOP

Steven B. Craig, Superintendent. The Instrument Shop manufactures special planetarium projectors and other devices for our own institution, and during the report year constructed five Foucault pendulums for educational institutions in Pennsylvania, Florida, Michigan and Iowa. In addition, the shop does a myriad of routine and sometimes extraordinary electronic and mechanical installations throughout the Academy. For example, 16,000 feet of wire were used in one installation in the planetarium, for the new skyline projectors. A sound system was installed at the aquarium dolphin tank, and another in the Edward Hohfeld Hall of Space Science.

Mr. Cary Ponchione joined the staff as Senior Technician.

JUNIOR ACADEMY

Kenneth E. Lucas, Supervisor and Darrel McKenzie, Instructor. The California Junior Academy of Sciences provides stimulation, instruction, and facilities for a special group of some four hundred young people who are interested in learning about the world of nature. The group is "special" in that its members are alert, inquiring, concerned, and bright. Students who participated were between 9 and 18 years of age, and those over 15 usually pursued courses of independent study and assisted with the classes and field trips for the younger junior academicians. Eighteen different formal courses were offered during the year, in Saturday classes and the summer program. Supervisor Lucas persuaded professional staff members from several of the other departments to offer courses. There were also courses in which parents shared learning experiences with their children, over tidepools or in the planetarium.

Top, Earl Collison, a senior at Analy High School in Sebastopol, and contestant in the 17th San Francisco Science Fair, won the coveted Academy Special Award for his work on the distribution of oak galls. Dr. Robert T. Orr, Associate Director, presented a plaque, certificate, and fifty dollar cash prize. Mr. Collison was also given a one hundred dollar research grant for the continuance of his investigations.
Above, Dr. Lindsay and Congressman Ogden Reid (Rep-NY) discussed environmental education legislation before hearings held at the Academy on May 1. Congressman Orval Hansen, (Rep-Idaho), center, and Congressman John Brademas (D-Ind), right, were members of the investigating team. Left, more than 200,000 persons attended Morrison Planetarium programs during the year.

The field trips were more ambitious than ever, and included a dinosaur hunt in Colorado under the direction of Mr. Lucas and Mrs. Jean Firby, a course in vulcanology held at Lassen Volcanic National Park taught by student-member Mark Ghiorso, fish fossil hunts in Nevada with Darrel McKenzie, and many shorter excursions.

The Junior Academy also served as an information center, responded to questions from the general public, helped with tours for special groups, and provided facilities and equipment for a special Elementary Science Resource Center of the San Francisco Unified School District.

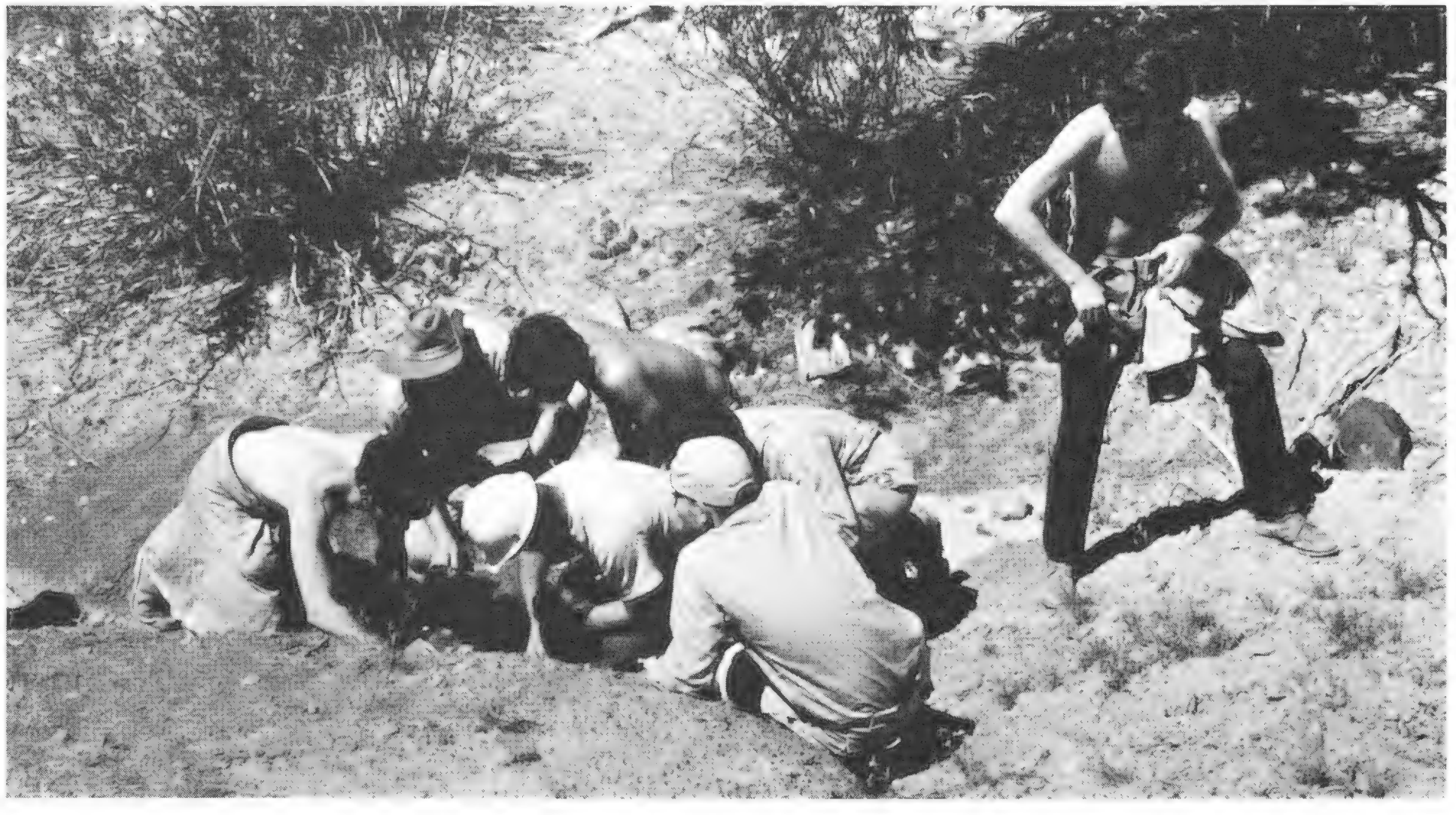
ELEMENTARY SCIENCE RESOURCE CENTER

During the fiscal year the Elementary Science Resource Center, which was started at the Academy early in 1969 by the San Francisco Unified School District with funds provided under Title III, ESEA (Public Law 89-10), continued to be very active. The purpose of the program has been to select a racially-mixed group of gifted children and to train them as docents to teach science to other pupils visiting the Academy. In Phase I sixty-five fifth grade boys and girls were chosen from twenty-two schools. They were divided into groups of about thirteen and each group was brought to the Academy by bus one day a week for lectures and field trips. Morrison Auditorium and the facilities of the Junior Academy were made available and a small room in North American Hall has served as a headquarters and office for the personnel involved. Phase I of the program was completed in February and Phase II followed with an additional 104 docent trainees. In Phase II the training program was enlarged to include the physical sciences. Both the biological and physical sciences series were built around museum exhibits.

The program was developed by Mr. Isadore Pivnick, Assistant Superintendent for Innovative Planning for the San Francisco Unified School District; the Project Director is Virginia Ryder.

DOCENT COUNCIL

In mid-year a Docent Council was organized under the direction of Trustee Mrs. Joseph A. Moore, Jr., with the help of Mrs. Austin Morris. The purpose was to develop a program to train volunteers to give informative tours of the Academy's halls to visiting students and special groups. The eight persons comprising the Council were Mrs. Donald Fisher, Mrs. Peter Haas, Mrs. Austin Morris, Mrs. Alan Nichols, Mrs. George Osborne, Mrs. Roland Perkins, Mrs. William Sanborn, and Mrs. John Schaupp. Mr. and Mrs.



Above, students guided other students through the exhibit halls, under a program developed by the San Francisco Unified School District with Federal funds. An Elementary Science Resource Center is maintained at the Academy. One hundred sixty-nine fifth grade students were trained to be guides for other pupils visiting the Academy. Right, Junior Academy field trips included a dinosaur hunt in Colorado. Mr. Kenneth Lucas and Mrs. Jean Firby led the group which was guided by Mr. Ed Gregory of Montrose, Colorado.

Walter A. Haas provided a gift of $5,000 for the support of the project and Mrs. Kathleen Bowman was hired as secretary-coordinator. A series of ten weekly lectures on mammals, birds, reptiles, amphibians, insects and general ecology was developed by Dr. Robert Orr with the cooperation of Dr. Paul Arnaud, Dr. Laurence Binford, Dr. Earl Herald, Dr. Edward Kessel, Dr. George Lindsay, Dr. Alan Leviton and Dr. Robert Miller of the Academy staff and Dr. William Sanborn of the San Francisco Unified School District. Classes in the fall of 1969 and spring of 1970 resulted in the graduation of 42 active docents. By mid-June tours had been given to 55 different groups comprising nearly 2,000 children and adults. In addition to tours, the docents have been active in providing an information desk to serve the public in Cowell Hall.

In the spring of 1970 a series of four advanced seminars were given for the fall graduates and a newsletter entitled *TOURisms* was published monthly under the editorial supervision of Mrs. Rex Butler. The two basic courses given so far have covered material dealing with North American Hall. In the fall of 1970, in addition to a third basic class, there will be an advanced class to prepare docents to give tours of Simson African Hall, Fossil Hall and certain other exhibits in the Academy's buildings. This will be open only to those who have completed the basic course.

J. W. MAILLIARD, JR., LIBRARY

Ray Brian, Librarian. The central library is responsible for the accumulation and maintenance of printed materials for the Academy scientists and students, Academy members, and visiting scholars. It manages the exchange of the Academy's scientific publications for those produced by several hundred other institutions, and it is also responsible for the specialized libraries located in each research department.

Library Associates Julian Arntz, Margaret W. Campbell, and Jessie Saunders regularly gave their time, as did Mr. Paul H. Anderson, to augment the regular staff of five plus several student assistants employed by the Academy under provisions of the Federal Economic Opportunity Act. The help of the volunteers was most important.

PICTURE COLLECTION

Johan Kooy, Chairman. The Academy's history, its expeditions, the look of the California landscape of the 19th Century, and the changing landscape of today, are reflected in the photographs and prints stored in this department. The pictorial records of plants, wildlife, and geological features of the western United States and the world are available for research and educational applications both within and outside the Academy.

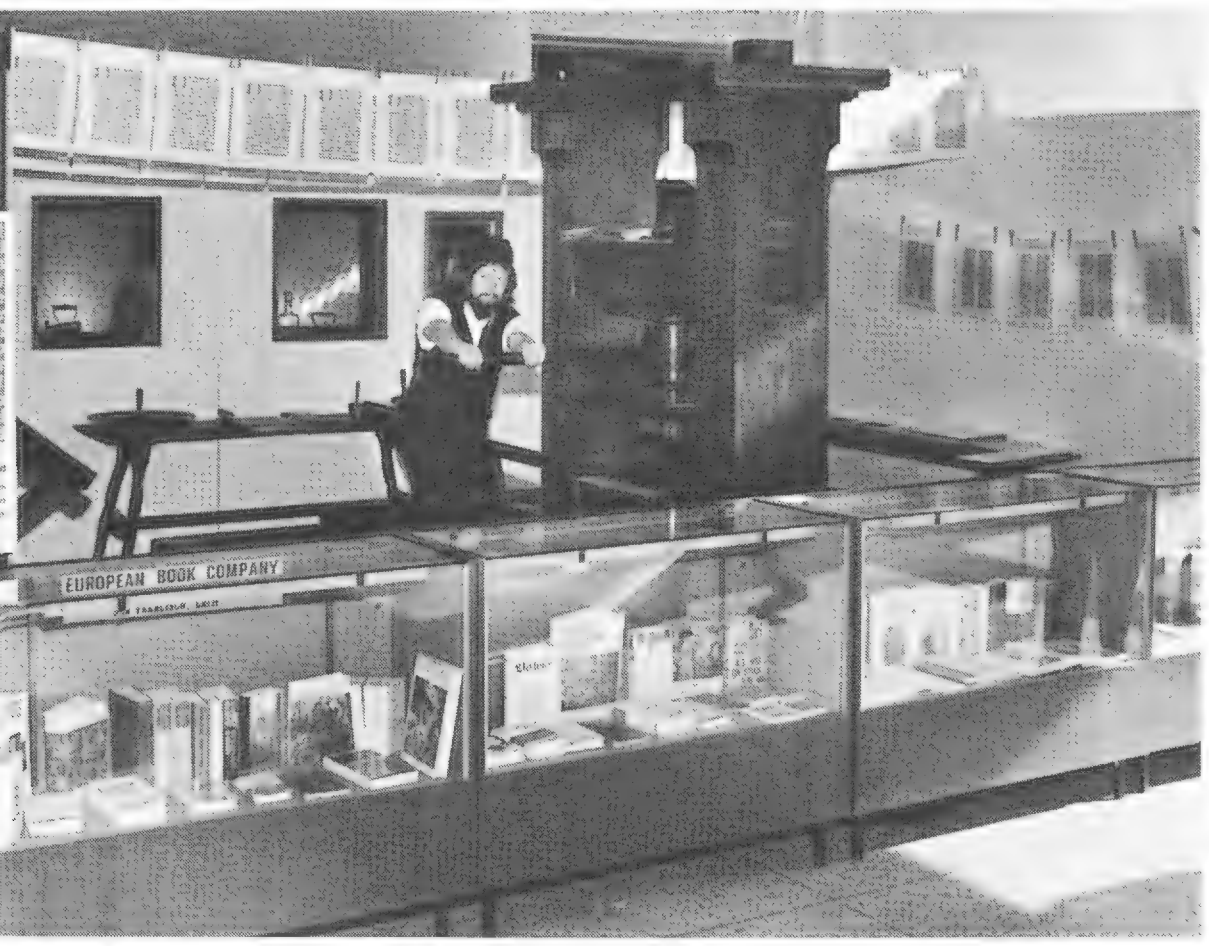
An average year sees some 100,000 new additions processed into the collection by volunteers, each of whom works in some specific field of nature. Approximately 4,000 illustrations were loaned during the year for book and magazine illustrations and for television, lecture and exhibit uses.

Two important sections of the collection are administered by Associates. Miss Muriel French is in charge of the widely used transparency collection and Mr. Paul Anderson directs the Reference Picture Collection, from which the greatest number of loans are made.

With the exception of the Chairman, the department is staffed entirely by volunteers, who are recognized in a special section of this report. The past year was notable for important gifts of 18th and 19th Century nature prints from Mr. Anderson and the contemporary botanical prints of Mr. Henry Evans given by Mr. and Mrs. Stephen D. Bechtel, Jr. Mrs. F. Somers Peterson made generous donations to departmental equipment needs as did Miss French, Mr. Anderson, and the Frank Campini Foundation.

The Docent Council developed a program to train volunteer guides, and forty-two docents were graduated from two ten-week courses. Council members were, center: Academy Trustee Mrs. Joseph A. Moore, Jr., Mrs. Austin Morris, and Mrs. John B. Schaupp; second row: Mrs. Alan Nichols, Mrs. Roland Perkins, Mrs. William Sanborn, Mrs. George Osborne, Mrs. Donald Fisher, and Mrs. Peter Haas.

Right, the Hall of Fossils was converted from a restaurant with the opening of new facilities in Cowell Hall. Below, a special exhibit devoted to Johannes Gutenberg and his printing was provided by the government of West Germany. Far right, the dioramas in Simson African Hall made "safari trips" easy for hundreds of thousands of visitors.



PACIFIC DISCOVERY

Bruce Finson, Editor, and Johan Kooy, Art Director. *Pacific Discovery,* a popular bimonthly journal of nature and man in the Pacific world, reflects the interests and activities and concerns of our institution and is published for Academy members. It is a quality magazine with lavishly-illustrated articles about the natural environment and its values.

The press run of *Pacific Discovery* was increased to 8,000 this year, and a new printing process was adopted to insure high fidelity reproduction of photographs.

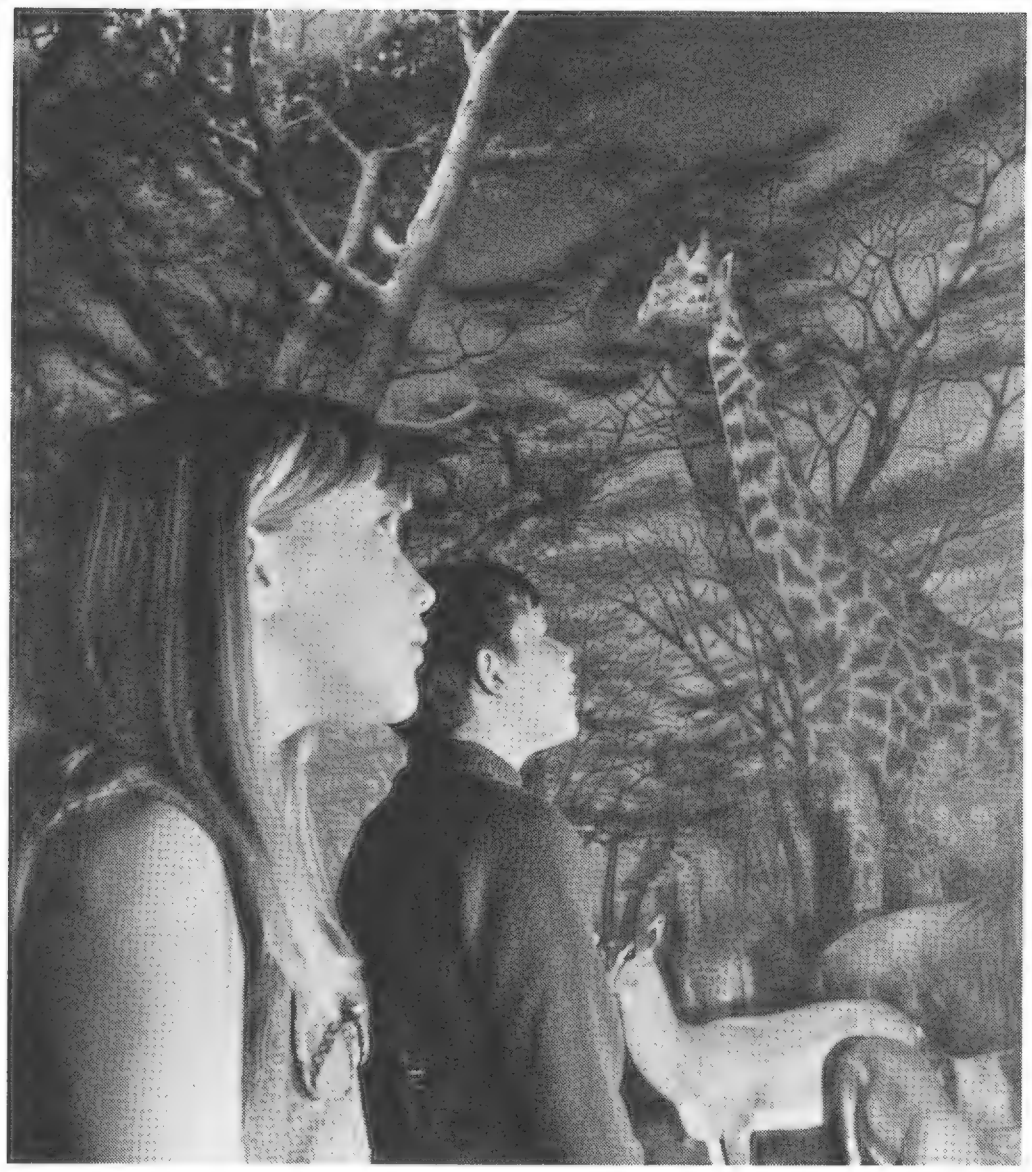
Drs. Robert I. Bowman, George Lindsay, Robert C. Miller, and Robert T. Orr serve on the Editorial Board.

EXHIBITS

Ernest R. Rook, Chairman and Curator. Planning for the orderly development of a coordinated exhibits program throughout the Academy occupied the exhibits personnel most of the year, but did not preclude the opening of a modest Entomology Room off the North American Mammal Hall and some other new installations. In the Hall of Fossils, part of which was formerly occupied by a restaurant, Jerry Glover placed his cast of a 30-foot Plesiosaur on one wall and simulated a "dinosaur dig" with an exhibit of a *Dilophosaurus* cast which one views at the bottom of a pit in the center of the room. The fossil remains of a rare swimming reptile, *Brazilosaurus,* was donated by Mr. and Mrs. Lewis K. Land. A great dinosaur track and the real tusk of a mammoth are placed so visitors can touch them.

A special display was made to show a remarkable mineral specimen given by Arthur Court. It is a smoky quartz crystal encrusted with a halo of rare rose quartz crystals. Called "Halley's Comet," the specimen was featured in an article in *Esquire* magazine.

Through the cooperation of the Government of West Germany, Northern California newspaper publishers, and the San Francisco Public Library, a special show was presented in November, "Printing Transforms the World—Johannes Gutenberg, 1400-1468." Another exhibit which



was produced by university students in Sweden concerned human over-population, and was sponsored by the Swedish Consulate. Silk screen reproductions of cave paintings of North Africa by Douglas Mazonowicz were obtained from the Smithsonian Institution for a two-month display. Mr. Mazonowicz addressed two members' meetings during the exhibition. An exhibit of color photographs of Baja California by David Roderick coincided with Mr. Roderick's lecture to the members in January. There were other temporary exhibits and exhibit developments.

Miss Verdi Miller organized the Exhibits Department storage areas and systems, utilizing new metal storage cases.

PUBLIC INFORMATION

Hal Richardson, Public Information Officer. Mr. Richardson lets the world know what is going on at the Academy, and he is aided by newspapers, magazines, and radio and television stations which give free space and time for his announcements and feature stories. We appreciate this important help from the media. Regularly publicized were Morrison Planetarium programs, special exhibits, unusual arrivals at Steinhart Aquarium, and astronomy and Junior Academy training courses.

Mr. Richardson writes and publishes the *Academy Newsletter* and the "Academically Speaking" column in *Pacific Discovery,* and arranges for the membership meeting programs and many special events.

Mrs. Walther Buchen continued her volunteer services in maintaining the extensive press book, and Miss Muriel French made a detailed survey of all articles published about the Academy during 1969.

DEVELOPMENT AND MEMBERSHIP

Raymond L. Finehout, Director of Development and E. Sue Weaver, Membership Coordinator. In addition to its major responsibility, the long-range development and financing of the Academy, the Development Office conducts continuing programs for corporate, foundation and individual support, coordinates membership activities, and provides staff assistance to Trustee committees overseeing these activities.

Chairman E. Morris Cox and Trustees John A. Sutro, Frank E. Hayward and E. W. Bullard, Jr. headed programs for annual support from individuals and corporations.

Mrs. Joseph A. Moore, Jr. was Chairman of the Membership Committee the activities of which increased adult membership twenty-five percent during the year. Mr. Thomas Tilton planned several natural history field trips for members and the first took place in May. This was to San Diego to visit the Zoo and Sea World.

Development and membership activities benefited greatly from the help of regular volunteer workers. In particular the staff acknowledges gratefully the work of Miss Dorothy Newington, Mrs. James W. Griffith and Mrs. Erlene Shopes.

RESEARCH ACTIVITIES

The California Academy of Sciences has a twofold purpose. One of these is to maintain exhibit halls and carry on public education. The other is to conduct basic research in the natural sciences and preserve adequate examples of plants and animals both Recent and fossil, as well as rock and mineral specimens. It is with this second phase of its activities that its seven major research departments are primarily concerned. Each is staffed with trained scientists and technicians who maintain the Academy's collections and add to them personally by field exploration in various parts of the world as well as by exchanges with other related institutions and by encouraging gifts from friends. Such collections, while valuable in themselves, increase greatly in importance when they are used in scientific research not only by the curatorial staff but by scientists from other organizations. Each year hundreds of published pages appearing in the Academy's technical publications as well as those of other learned societies attest to results of these activities.

This year the Science Council consisted of A. Starker Leopold, Chairman, Ralph Emerson, Vice-Chairman, Alan Leviton, Secretary, Paul H. Arnaud, Jr., Ian Campbell, J. Wyatt Durham, George Lindsay, Robert T. Orr, Thomas Tilton, and Victor A. Zullo. This is a standing committee of the Board of Trustees, chaired by the President of the Academy, with staff representation. Its duty is to advise the Director in matters relating to the institution's scientific activities.

One Tree Island in the Great Barrier Reef was visited by Dr. and Mrs. William N. Eschmeyer when they participated in an expedition of the Australian Museum.

BOTANY

Elizabeth McClintock, Curator and Acting Chairman. Dr. John H. Thomas was appointed Curator in October 1969, in connection with his academic appointment as Associate Professor at Stanford University, and he divides his time between the institutions. At Stanford he teaches and is in charge of the Dudley Herbarium. The joint-appointment arrangement helps coordinate the accessions and activities of the two herbaria, which is particularly important in view of their eventual consolidation. Dr. Dennis Breedlove was appointed Assistant Curator in October 1969.

The Academy's herbarium had 515,633 specimens on June 15, 1970, an increase of 34,279 during the past year.

Dr. McClintock continued her work with horticultural plants and her collaboration with the Bailey Hortorium at Cornell University toward the completion of *Hortus Third,* completing the manuscript treatments of four families. She also finished a revised guide list to the plants of Strybing Arboretum.

Dr. Breedlove continued his research on the botany and ethnobotany of Chiapas, undertook field work in the remote Sierra Surutato of northeastern Sinaloa, and carried on work with butterfly food plants and the population biology of *Fransera speciosa.*

Curator Emeritus John Thomas Howell completed a supplement to his *Marin Flora* which was republished by the University of California Press, and is continuing work on the flora of the Sierra Nevada.

The National Science Foundation institutional support grant provided the salary of one technical assistant and funds for the purchase of fourteen new herbarium cases. Three new offices were constructed for the department using Academy building funds.

ENTOMOLOGY

Paul H. Arnaud, Jr., Chairman and Associate Curator. The Department of Entomology maintains a collection of about 5,600,000 insects and other arthropods, including 87,557 specimens which were accessioned during the year. The service aspects of the research collections were demonstrated by the loans of 54,453 specimens in 227 separate transactions. One hundred fifty-one persons at 83 different museums, universities and other institutions borrowed 49,396 specimens and the other 5,057 were loaned to private individuals. Shipments were sent to 12 foreign countries. Most of the loans within the United States went to graduate students.

The National Science Foundation institutional support grant provided $10,000 for technical assistants, $4,360 for the purchase of forty masonite cases, and $1,465 for the materials for 543 glass-topped specimen drawers which will be fabricated in the Academy shops. This grant was particularly timely because 3,200 square feet of additional space were made available to the crowded department when the executive offices of the Academy were moved to Cowell Hall. The entire entomological collection was reorganized, and some 11,000 primary type specimens were relocated into a fire and earthquake proof vault.

Dr. Arnaud continued work on a host catalog of North American Tachinidae, with support from the U.S. Department of Agriculture. Curator Dr. Edward S. Ross spent most of the year, from October 14 to June 17, on a collecting and photographic trip around the world. Associate Curator Hugh B. Leech continued his research and field

work on Coleoptera. Mr. Michael Irwin of the University of California, Riverside, participated in the African part of that expedition.

Research Associate Dr. Stanley C. Williams continued his research on the systematics, distribution, ecology and behavior of scorpions, with support from the National Science Foundation. Logistic support and transportation for Williams and his assistants to study the scorpion faunas of the islands of the Gulf of California were provided by Mr. Thomas P. Hearne of San Diego and Mr. Richard Dwyer of Corona Del Mar.

GEOLOGY

Victor A. Zullo, Chairman and Associate Curator. Five new offices were constructed in the Department of Geology, and another office outside the department was assigned to Dr. and Mrs. G Dallas Hanna. These improvements were financed by Academy building funds. The collection rooms were partially rearranged to provide working space for Mr. Roth, an assistant provided by the National Science Foundation institutional support grant, and he continued the organization of the enormous collection of Recent mollusks. The departmental type collection has 108 additions and totals 13,318 specimens, and 1,368 specimen lots were added to the general collections which now total 43,148 lots.

Academy Trustee Ian Campbell became a Research Associate with his office located in the new mineralogy section.

Dr. Zullo continued his studies of Recent and fossil barnacles and of the biogeography and stratigraphy of the late Cenozoic cold-water faunas of the Pacific Coast. Dr. Hanna continued his active investigations of diatoms and silicoflagellates from the Eocene of the South Atlantic Ocean, the Caribbean Sea, and the Indian Ocean. He and Mrs. Hanna spent October through December 1969 in the Far East, and especially in New Zealand and Australia visiting classic diatom localities and studying collections in various museums. Curator Emeritus Hertlein continued his research on the Pliocene bivalves of San Diego, the fossil mollusks of the Lomita Quarry, and the gastropods of the San Diego formation. Research Associate Galloway devoted all of his available research time to his monographic study of the geology of the Point Reyes Peninsula.

HERPETOLOGY

Alan E. Leviton, Chairman and Curator. Perhaps the most significant accomplishment during the year was the transfer to the Academy of catalogued herpetological collections formerly housed at Stanford University. Mr. James Harvey, the National Science Foundation supported technical assistant, completed this transfer in May. Some of the catalogued specimens have been incorporated into the main research collections but most are stored awaiting the installation of shelving in a new 840-square-foot collection room which the Academy supplied. Additional uncatalogued Asian collections accumulated by Dr. Walter Brown, numbering 15,000 to 20,000 specimens, will be transferred as time permits.

The department accessioned 3,057 additional specimens, including collections from New Guinea, Kenya, North Africa, South America, Afghanistan, Palau Islands, South Africa, Mexico, Madagascar, Baja California and Colombia.

The NSF grant provided a Wild stereoscopic microscope with camera lucida and other attachments.

Dr. Leviton continued work on Philippine snakes,

Visitors occasionally see some of the 5,600,000 specimens in the Department of Entomology. Here Curator Hugh B. Leech displays collections during an open house.

Old bones give information about the past fauna of the Farallon Islands. Fur seals and other marine mammals, now extinct, once lived there. Mrs. Jean Firby here sorts bones recovered from island middens.

undertook the preparation of a general account of North American amphibians and reptiles for a trade book, and with Dr. Anderson completed a checklist and key to the amphibians and reptiles of Afghanistan. Research Associate Brown was awarded a grant through the Academy for the continuation of his studies of the tropical ecology of the Philippine Islands. Field Associate Papenfuss spent the year studying and traveling in Africa, with some support from the Academy.

Fifty loans of reptiles and amphibians involving 1,760 specimens were processed during the year and 1,394 specimens are currently on loan to various institutions.

ICHTHYOLOGY

William N. Eschmeyer, Chairman and Associate Curator. Whereas last year saw the completion of the merger of the Vanderbilt collection of about 45,000 bottles (specimen lots) with the original department collection of 35,000 specimen lots, this year preparation was begun for the transfer of the Stanford University collection of about 70,000 specimen lots. Funds to defray part of the expense of this transfer are expected from the National Science Foundation. The combined collection will be one of the largest in the world and one of unusual historical importance because of the many publications which are based on the Stanford specimens. Several thousand bottles of the Stanford collection, including about 800 holotypes, have already been transferred. In addition, 1,385 specimens, including the types of nine new species were accessioned from other sources. Perhaps the most noteworthy addition was our first preserved coelacanth from the Comoro Islands, a purchase arranged by Dr. Herald.

Dr. Eschmeyer received $22,372 from the National Science Foundation in September 1969 for a study of Indo-Pacific scorpionfishes, a group which is medically important and commercially valuable. On October 15 Dr. and Mrs. Eschmeyer left for nearly five months of foreign travel, visiting most of the major and many of the minor museums of the world. Except for ten days of field work on the Great Barrier Reef, most of their research time was spent examining scorpionfishes, particularly type specimens, held by other museums.

Curator Emeritus W. I. Follett continued his ethnoichthyological studies and worked on the list of California fishes in conjunction with Carl L. Hubbs and Lillian Dempster. Mrs. Dempster also began work with Dr. Eschmeyer on the scorpionfishes.

About 5,560 specimens were loaned in 67 transactions, and sixty scientists and graduate students worked on their research problems at the Academy.

INVERTEBRATE ZOOLOGY

Victor A. Zullo, Acting Chairman. Associate Curator Allyn G. Smith retired from the department chairmanship in order to give full time to research, and Dr. Zullo was appointed Acting Chairman in March 1970.

The invertebrate zoology collections now exceed 35,000 specimen lots, and 1,550 lots were accessioned during the year. Particularly significant were collections from Japan given by Franz B. Steiner, from Baja California by Bruce Marquardt, and from Southeast Asia by George Mendenhall.

The National Science Foundation institutional support grant provided the salary of Curatorial Assistant Dea B. Beach, who identified and accessioned 2,800 specimen lots of barnacles and otherwise aided Dr. Zullo with his barnacle research.

Associates James T. Carlton and Ralph O. Fox were of great assistance in aiding professional visitors and other departmental activities.

ORNITHOLOGY AND MAMMALOGY

Robert T. Orr, Chairman and Curator. There are approximately 82,000 birds and 20,000 mammals in the department's collections, to which 311 mammals and 42 birds were added during the year. Sixty-one specimens of marine mammals were among the important acquisitions.

Dr. Orr is Associate Director of the Academy, and he is also directly responsible for this very active department. He served as a delegate of the State Department in negotiating a treaty with Japan on migratory and endangered birds; at the request of the National Academy of Sciences he served as host for Dr. Vladimir Sokolov of the USSR Academy of Sciences; and he was otherwise active in state, national and international conservation problems. Dr. Orr's newest book, "Animals in Migration," was published in June 1970, and his textbook, "Vertebrate Biology," appeared in a Spanish edition.

Dr. Laurence C. Binford, Assistant Curator, undertook a major reorganization of the bird collection. Fourteen new specimen cases were purchased with National Science Foundation institutional support funds, which also provided the salary of one technical assistant. A new marine mammal room was equipped with storage cabinets by the Academy.

Research Associate John R. Arnold and Mr. Craig Moe conducted field research on the mammals of the Sierra de Miahuatlan, Oaxaca, Mexico, from December 20, 1969 to February 1, 1970. This Academy project is carried on with the permission and cooperation of the government of Mexico.

SCIENTIFIC PUBLICATIONS

Edward L. Kessel, Editor. Eight hundred eighty pages of scientific publications and indices to publications were issued this year, and included 680 pages of *Proceedings* and 200 pages of *Occasional Papers*. The greatest accomplishment was the completion of comprehensive indices of six volumes of *Proceedings* through the volunteer help of Mrs. G Dallas Hanna and Mrs. Ira L. Wiggins.

Mrs. Diana Young joined the staff as editorial assistant in February 1970.

WORK STUDY PROGRAM

The EOA program of the U.S. Department of Health, Education and Welfare provides financial assistance to students who might otherwise be unable to attend college. The Academy, under contracts with San Francisco State College and the University of California, employed 58 students who worked 18,593 hours and earned $43,746. Of this the Academy paid $8,749. For the report period the total EOA hours represent the equivalent of more than 10 full time positions. The students gained valuable work experience and technical training in the research departments, library and instrument shop. Dr. Alan E. Leviton was in charge of the EOA program at the Academy.

George E. Lindsay

GEORGE E. LINDSAY
Director

Summertime visitors to the Academy enjoy the refreshing Whale Fountain in the courtyard.

STAFF LIST

(as of June 30, 1970)

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William Clark, *Night Guard*

NOTES

EOA—*Economic Opportunity Act. Work-study student sponsored by the Federal Government Health, Education and Welfare Department through the University of California, Berkeley, or San Francisco State College.*

NSF—*National Science Foundation sponsored.*

ACADEMY VOLUNTEERS

During the year many of the Academy's activities were augmented by volunteers who generously donated their time and services. Some assisted in the various departments: typing, cataloging, and performing other necessary tasks, while others served as docents after completing the docent training course. We are most grateful to the following:

Mrs. Merritt Adelman, Docents
Mr. Paul Anderson, Library
Mrs. Mary J. Anger, Docents
Mr. Grant Bailey, Invertebrate Zoology
Mrs. Richard Boede, Docents and Picture Collection
Mrs. Dennis Breedlove, Botany
Mr. Richard M. Brown, Entomology
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BREEDLOVE, DENNIS, BRENT BERLIN and PETER H. RAVEN

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CALIFORNIA ACADEMY OF SCIENCES

BALANCE SHEET, JUNE 30, 1970 AND 1969

ASSETS

	1970	1969
Cash		
Commercial accounts	$ 60,671	$ 279,334
Savings accounts	106,995	295,019
	167,666	574,353
Receivables		
Research grants		
National Science Foundation	43,743	53,175
Other federal agencies	5,616	4,816
City and County of San Francisco	25,059	—
Other	8,095	6,433
	82,513	64,424
Inventories at lower of cost or market	13,754	9,971
Investments, at cost		
Land	608,084	608,084
Commercial Building	516,819	516,819
Accumulated depreciation	(516,819)	(516,819)
Marketable securities		
Special purposes fund (market 1970–$509,412, 1969–$477,218)	635,776	442,784
Endowment fund (market 1970–$1,461,077, 1969–$1,641,866; pledged $210,000)	1,738,426	1,496,296
	2,982,286	2,547,164
Buildings (Note 2)	—	—
Collections, library, and equipment (Note 3)	—	—
Unamortized lease commissions	9,731	10,419
	$3,255,950	$3,206,331

LIABILITIES AND FUND BALANCES

	1970	1969
Note payable to bank with interest at 8%, due September 15, 1970, with securities pledged as collateral	$ 210,000	$ 210,000
Accounts payable	15,064	—
Accrued liabilities	14,564	4,871
Unexpended construction funds	—	179,843
Total liabilities	239,628	394,714
Fund balances		
Operating, unrestricted	41,513	94,634
Endowment, unrestricted	2,171,923	1,941,702
Restricted to research	82,272	70,263
Restricted to plant improvements	30,493	63,943
Restricted to other special purposes	690,121	641,075
	3,016,322	2,811,617
	$3,255,950	$3,206,331

The accompanying notes are an integral part of the financial statements.

CALIFORNIA ACADEMY OF SCIENCES

DETAIL OF CHANGE IN UNRESTRICTED OPERATING FUND BALANCE FOR THE YEARS ENDED JUNE 30, 1970 AND 1969

	1970	1969
INCOME		
Contributions (Note 1)		
Membership dues	$ 64,247	$ 46,706
Business organizations and foundations	55,300	44,165
Individuals and trusts	45,009	26,687
	164,556	117,558
Interest, dividends, and overhead reimbursements		
Contract research fund	16,823	22,885
Endowment fund	74,693	65,665
Special purposes funds	55,335	44,052
	146,851	132,602
Operations		
From the City and County of San Francisco for support of aquarium and museum operations	553,177	524,490
Rent from Commercial Building	137,140	149,384
Planetarium	143,215	120,588
Television	4,155	3,834
Restaurant royalty	48,749	36,582
Sundry sales	150,771	102,386
Other	29,275	37,956
	1,066,482	975,220
Total income	1,377,889	1,225,380
EXPENDITURES		
Aquarium and museum	566,381	542,059
Planetarium	74,687	81,710
Departmental research and curatorial activities	324,015	281,591
General and administrative	326,348	270,347
Cost of sundry sales	155,076	104,579
Employees' pension annuity (Note 4)	27,548	15,706
Interest	16,955	13,562
Total expenditures	1,491,010	1,309,554
Excess of expenditures over income	(113,121)	(84,174)
APPROPRIATIONS FROM OTHER FUNDS		
Endowment fund	60,000	85,000
Special purposes funds	—	23,774
	60,000	108,774
Increase (decrease) in unrestricted operating fund	(53,121)	24,600
BALANCE, JULY 1	94,634	70,034
BALANCE, JUNE 30	$ 41,513	$ 94,634

The accompanying notes are an integral part of the financial statements.

CALIFORNIA ACADEMY OF SCIENCES

STATEMENT OF CHANGE IN FUND BALANCES
FOR THE YEARS ENDED JUNE 30, 1970 AND 1969

	1970	1969
INCOME AND BEQUESTS		
Contributions (Note 1)		
Membership dues	$ 64,247	$ 46,706
Business organizations and foundations	73,317	53,956
Individuals and trusts	357,752	455,591
	495,316	556,253
Operations	1,134,290	966,298
Endowment	293,529	246,786
Total income and bequests	1,923,135	1,769,337
EXPENDITURES	1,718,430	1,511,085
Excess of income and bequests over expenditures	204,705	258,252
BALANCE, JULY 1	2,811,617	2,553,365
BALANCE, JUNE 30	$3,016,322	$2,811,617

The accompanying notes are an integral part of the financial statements.

NOTES TO FINANCIAL STATEMENTS
JUNE 30, 1970

1. Accounting Method

The Academy has established the practice of recording gifts and bequests only when received.

2. Buildings

No amount appears on the balance sheet for buildings because under the terms of the Charter of the City of San Francisco, no one other than the City may hold title to buildings on City property. Thus, as the Academy facilities in Golden Gate Park (which is City property) were acquired, title was transferred to the City of San Francisco. The buildings, including Cowell Hall, were valued by independent appraisal at $15,671,000.

3. Collections, Library, and Equipment

The Academy staff has estimated the replacement cost of collections, library, and equipment to be in excess of $10,000,000.

4. Employees' Pension Annuity Plan

On January 1, 1964, the Academy adopted a pension annuity plan for all regular full-time staff members under the age of 59 as of that date.

Contributions to the plan are based on 5% of employee's salary to $7,800, and 7.5% of salary over that. The pension annuity expense was $27,548 for the current year. There is no past service liability and it is the Academy's policy to fund current pension costs.

ACCOUNTANT'S REPORT

The Board of Trustees
California Academy of Sciences
San Francisco, California

We have examined the balance sheet of the California Academy of Sciences as of June 30, 1970 and the related statement of change in fund balances for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the accompanying balance sheet and the related statement of change in fund balances present fairly the financial position of the California Academy of Sciences at June 30, 1970, and the results of its activities for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

HURDMAN AND CRANSTOUN, PENNEY & CO.

San Francisco, California
August 7, 1970

CONTRIBUTIONS

No summation of the year would be complete without acknowledgment of the support given the Academy by business organizations, private foundations and individuals. Much of the work of the California Academy of Sciences—be it scientific research, field expeditions, educational programs or public exhibits—has been made possible by such contributions, past and present. In addition to the physical plant, all of which was constructed through private gifts, many of its ongoing programs are funded by contributions, either directly through gifts, grants and bequests or indirectly through endowment or earnings of contributed property.

BUSINESS ORGANIZATIONS AND FOUNDATIONS

Through its annual support, the corporate community provides the resources needed for many of the Academy's educational activities, particularly those geared to the needs and interests of young people. Grants from private foundations and other organizations provide additional unrestricted support, as well as funding for specific projects. Corporate and foundation gifts were received from:

American Can Company
Ampex Corporation
Appert (Karen & Kristine) Foundation
Argonaut Insurance Co.
Atkinson (Guy F.) Company
Baldwin & Howell
Bank of America
Bank of California
Basic Vegetable Products
Bechtel Corporation
Belvedere Scientific Fund
Bercut-Vandervoort Co.
Birr, Wilson & Co., Inc.
Blume (John A. & Ruth C.) Foundation
Blyth & Co., Inc.
Bullard (E. D.) Company
California Canadian Bank
California Canners and Growers
Cal/Ink (Division of Tenneco)
Campini (Frank A.) Foundation
Caterpillar Tractor Co.
Chancellor Hotel
City Transfer & Storage Co.
Coffee (Stephen R.) Trust
Continental Can Co., Inc.
Continental Capital Corporation
H. S. Crocker Co.
Crocker-Citizens National Bank
Crown-Zellerbach Corporation
Del Monte Fremont Foundation
Deere (John) Company
Dodge & Cox
Dollar (The Robert) Co.
Eastman Kodak Company
Fairmont Hotel
Farquhar & Heimbucher
J. C. Fennelly Company
Fibreboard
Fireman's Fund American Life Insurance Co.
First Western Bank & Trust Co.
FMC Corporation
Foremost-McKesson, Inc.
Fromm & Sichel, Inc.
General Steamship Lines
Golden Gate Disposal
Gray (N.) & Company
Guittard Chocolate Co.
Haas Bros.
Hale, Newton J.
Harding, Miller, Lawson & Assoc.
Harris, Kerr, Forster & Co.
Harris, Upham & Co.
Haultain-Champion Co., Inc.
Hewlett-Packard Co.
Hexcel Corporation
Hills Bros. Coffee
Hurdman and Cranstoun, Penney & Co.
Industrial Indemnity Co.
Jenkel-Davidson Optical Co.
Johnson & Higgins of California
Jonwil Corporation
Kaiser Industries Corporation
Kendrick (Charles) Memorial Fund
Lenkurt Electric Co.
Lerner (Syril) Foundation
Little (Arthur D.) Foundation
Lybrand, Ross Bros. & Montgomery
Lyman (The Maud E.) Memorial Fund
Mailliard & Schmiedell
Masson (Paul) Vineyards
Merrill Lynch, Pierce, Fenner & Smith
Merriman (E. S.) & Sons
Metro-Goldwyn-Mayer
Meyer (Milton) & Co.
Meyer (Wilson & George) & Co.
Morrison-Knudsen Co., Inc.
Muhs (Fred R.) Family Foundation
Nelson (James A.) Co., Inc.
Oakes (The Roscoe & Margaret) Foundation
Pacific Coast Engineering Co.
Pacific Far East Line
Pacific Gas and Electric Company
Pacific Intermountain Express Co.
Pacific Telephone & Telegraph Company
Parrott & Co.
Perini Corporation
Peterson, C. Norman
Pflueger, Milton T.
Pope & Talbot, Inc.
Potlatch Forests
Price Waterhouse & Co.
Retail Dry Goods Assn. of S.F.
Rolph-Nicol Fund
Safe-T Pacific Company
Schlage Lock Co.
Security Pacific National Bank
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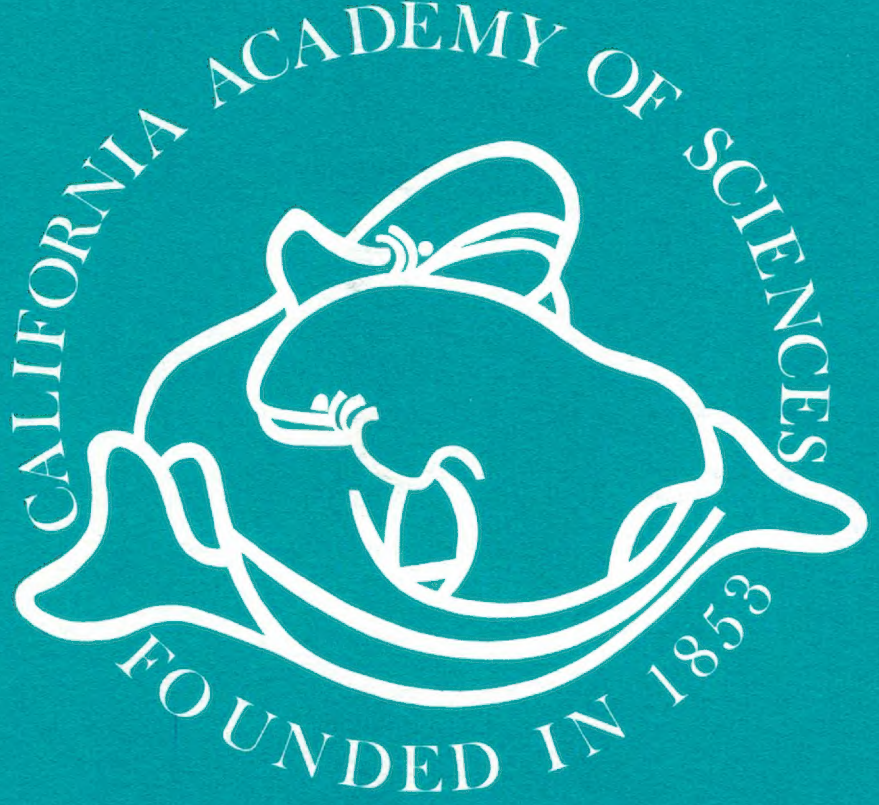

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